An inventory of the aquatic resources of the Broad River, with emphasis on fishes.

<u>**Introduction**</u>

The Broad River Mitigation Trust Fund was established to protect and enhance the fish community of the Broad River basin, South Carolina. Currently, a representative from the South Carolina Department of Natural Resources (SCDNR), the U.S. Fish and Wildlife Service (USFWS), Duke Power Company, and South Carolina Electric and Gas (SCE&G) serve as trustees, overseeing expenditures. Members of the Broad River Mitigation Trust Fund are referred to as the 'Trustees' in the body of the funding proposal to follow.

The Broad River basin, which originates in North Carolina, dominates the central Piedmont section of South Carolina. Within South Carolina, the river flows approximately 100 miles until it merges with the Saluda River to form the Congaree River. Average flow of the Broad River approximately 7 miles downstream from the North Carolina line (USGS gage # 1515) was 2,470 cfs while average flow 10 miles below Parr Reservoir (USGS gage #1615) was 6,250 cfs. In the upper part of the basin, where annual rainfall is highest, flows are well-sustained and moderately variable; as one travels downstream, flows become more variable as rainfall and groundwater support decreases (Snyder et al. 1983). Six hydropower dams are located on the South Carolina portion of the Broad River; these are Gaston Shoals, Ninety-Nine Islands, Lockhart, Neal Shoals, Parr Shoals, and Columbia. The S.C. Department of Health and Environmental control recently characterized water quality and the associated status of the aquatic community (DHEC 1998); at two of seven assessment sites, the aquatic community was not fully supported, due primarily to heavy metals. Climatological, hydrological, and limnological changes along the River's course create a variety of habitat types for aquatic organisms residing in the Broad River.

Baseline information on the present status and composition of the aquatic community of the Broad River watershed is needed to develop effective management and enhancement plans. The fishery resources of this watershed have received relatively little attention; the composition and status of the community are not comprehensively defined. In response to federal relicensing activity in the last decade, spot surveys of the fish community have been conducted in the immediate vicinity of the hydropower dams; little or no sampling has occurred in reaches of the river between these dams.

Objectives:

1. To comprehensively inventory the aquatic resources of the Broad River watershed, with emphasis on fishes.

2. To compare the fish community in the major habitat types (i.e., dam tailwaters, main river channel, and headwaters of impounded areas), specifically examining the possibility of fish community fragmentation associated with dams.

3. To compile habitat and natural resource data obtained in the current study and in previous efforts on a watershed-based database and make correlations between the status of the fish community and environmental variables such as dam location, hydrology, geology, water quality and quantity, and adjacent land-use.

4. To use the data collected from this effort to identify opportunities for protecting and enhancing the aquatic resources of the Broad River, with emphasis on the fish community.

Justification

A comprehensive inventory is the first piece of information that's needed to develop

effective natural resource management plans and identify fish enhancement opportunities for this river basin. If funded, this study will use less than 10 percent of total contributions to the mitigation fund to complete the needed inventory.

This survey will characterize the composition and biotic health of the fish community at sampled habitats along the entire watershed, establishing, for the first time, a baseline condition of the fish community in the basin. The relative condition of the fish community can serve as a general indicator of the health of the aquatic community in a river reach (Karr et al., 1986).

Use of a geographic database will define physical and chemical features of the basin that can affect the condition of the fish and aquatic community. Substantial amounts of information have been gathered on hydrology, geology, and water quality. This study will add information on the condition of riparian buffers, outfalls, and tributaries. This information will be added to the existing database on hydrology, geology, and water quality and correlated with biotic information gathered in the study. Once this inventory is completed, a vast majority of the fund's resources can then be targeted by the Trustees toward basin-wide, resource protection and enhancement opportunities identified by this effort.

Methods

A full study plan, subject to the review of the Trustees, will be developed during the first six months of the project. A summary of the expected, general content of the full study plan is presented below.

Sufficient sampling sites will be established to characterize the aquatic community of the South Carolina portion of the Broad River watershed. Sampling sites will be established along the river's length to capture possible longitudinal changes in the fish community within the watershed.

Sampling sites will also be located at sites containing 'significant' habitats, such as a dam or a major discharge source, as they may exert an influence on the fish community

   At this time, six to ten sampling areas appear adequate to accomplish the study objectives. A sampling area will consist of a 1.6 km stretch of river containing navigable pool/run habitat and accessible riffle areas. An effort will be made to locate sampling areas at or near locations with a historic database, such as a U.S. Geological Survey (USGS) or S.C. Department of Health and Environmental Control (SCDHEC) monitoring station. Each sampling area will be sampled in spring and fall with boat (or tote barge) electrofishing in pool and run habitats and backpack electrofishing in riffle habitats.

   A sample in pool and/or run habitats will consist of boat electrofishing three randomly selected sites within an area. Each site will be a shoreline section, 200 m in length. Electrofishing output will be standardized and generator on time will be recorded. We will attempt to sample when river stage is below a predefined height to help ensure that fish are equally vulnerable to capture on all sampling trips. All stunned fish will be netted and placed in a live well. Once sampling is completed, the total catch and total weight for each species will be measured. Taxonomically difficult specimens will be sent to outside experts for confirmation; a reference collection will be maintained. Prior to sampling a site, temperature and conductivity will be measured.

   Backpack electrofishing and/or seining in riffle habitats for a set period of time will be used to augment fish community information obtained from run/pool habitats. Total number and weight for each collected species will be obtained. Data obtained from boat and backpack electrofishing will be used to calculate relative abundance, species diversity, and species richness

metrics for the fish community at each sampling area.

To assess fish population structure, length (mm), total weight (g), and sex will be obtained during the fall from all specimens of at least three fish species that commonly occur along the length of the river and are functionally different [e.g., largemouth bass (predator), redbreast sunfish (insectivore), and channel catfish (omnivore)]. Otoliths or spines will be collected to estimate growth of these species.

An autopsy-based fish health assessment index will be defined each fall for largemouth bass *Micropterus salmoides* at each study site. Goede and Barton (1990) developed an autopsy-based fish health assessment index for assessing trout populations in Utah; Brown and Hickman (1990) modified this index to allow evaluation of a warm-water fish community. Preliminary evaluations indicate that we will assess liver coloration, the ratio of liver wet weight to total somatic wet weight, and the presence of external parasites, as these metrics are key indicators of fish health (Mr. David Coughlan, Duke Power, personal communication). From these measurements, an index of the relative 'health' of the fish community will be obtained.

During reconnaissance and sampling visits, qualitative efforts will be made to identify macroinvertebrates at each study site, emphasizing decapods (i.e., crayfish) and pelecypods (mussels and clams). A species list of decapods and pelecypods will be compiled. Threatened species of these macroinvertebrates are known to occur in South Carolina; their presence can affect potential enhancement activities. Observations of sport fish utilization and available access will also be recorded during field trips.

Data will be entered into a watershed-based, geographic database, such as ARC/INFO. Ground-truthing of relevant GIS habitat data will occur at each sampling area and, if time permits,

at other 'significant' areas. Fishery data will be correlated with climatic, hydrologic, land use,

water quality, and macroinvertebrate community data. Climatic data will be obtained from local

weather stations operated by the National Weather Service. Hydrologic data will be obtained from

USGS gaging stations. Water quality and macroinvertebrate data will be obtained primarily from

SCDHEC and USGS sampling efforts. These correlations will be made to assess the findings of

the fish survey, possibly identifying factors that are affecting the biotic community at a sampling

site.

This sampling and database management strategy will provide a baseline definition of the

fish community; areas with relatively low abundance/diversity of fishes or 'poor' condition will be

identified. Biological survey data will then be used to identify enhancement, restoration, and

protection opportunities for the fish and aquatic community. Regular meetings with the trustees

will occur to promote discussion and evaluation of study findings.

Time line

July 1, 1999 - SCDNR to hire a biologist with the skills to be able to independently lead and

report on this effort.

July 1 - December 30, 1999 - Develop full study plan; evaluate gear, access and logistics of study.

January 10, 2000 - Send full study plan to Trustees and outside experts for review, comment, and

revision, as needed.

March 1, 2000 - February 28, 2001 - Begin first year of field sampling, historic data assimilation,

and data analysis.

July 1, 2001 - Issue Progress Report based on first year of data collection; meet with Trustees to

discuss initial findings and re-evaluate study plan and scope.

March 1, 2001 - February 28, 2002 - Second year of field sampling, historic data assimilation and

   data analysis.

July 1, 2002 - SCDNR will Issue Final Study Report, including the assembled database on

   compact diskette. The report will include 1) a characterization of the composition and

   health of the fish community, 2) opportunities for habitat enhancement, restoration, and/or

   protection, and 3) aquatic resource management recommendations. A meeting with

   Trustees will occur to discuss findings.

<u>Literature Cited</u>

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